Some Methodological Issues of Exchange in Oceanic Prehistory

TERRY L. HUNT AND MICHAEL W. GRAVES

EXCHANGE HAS EMERGED as a recurrent theme in Oceanic anthropology and prehistory. Despite long-standing interest in it, explanations are not well developed for why exchange systems originated, why they persisted or ceased, and how they operated. This is true not only for archaeologists but also for sociocultural anthropologists who have, in many cases, offered only particularistic descriptions of exchange networks. Explaining the role of exchange and interaction in the evolution of prehistoric Oceanic societies will require the solution of two problems, one technical, the other methodological. The first of these is the identification of commodities moved. Ideally, identification requires compositional characterization, which in some cases will permit determination of geologic provenance. In some instances, macroscopic characterization of stylistic features may also be used to infer the exchange goods. The second problem is less amenable to a technical fix: It involves linking patterns of exchange (deduced from distributional data) with explanatory models in island settings. We briefly examine these issues in this paper.

IDENTIFICATION

Archaeologists have traditionally approached exchange as a problem with three interrelated steps (Earle 1982:3–4). These are (1) to ascribe a source to the commodities of exchange; (2) to describe the spatial patterning of the commodities; and (3) to reconstruct the organization and/or the modes of prehistoric exchange (Renfrew 1975). To accomplish the third step, some archaeologists (e.g., Hodder 1980) have attempted to use analogues from contemporary systems and to describe exchange in ways that mirror ethnographic accounts.

Studies of exchange face the technical problem of developing means—through material analyses—to distinguish artifacts of local origin from those of exotic origin, in any particular archaeological assemblage. Much of this falls within the purview of the familiar area of research known as archaeometry, in which substantial advances have been made in recent years.

Terry L. Hunt is an assistant professor, and Michael W. Graves is an associate professor, in the Department of Anthropology, University of Hawaii, 2424 Maile Way, Honolulu, HI 96822.

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Lithic Studies

In Oceania, the characterization of obsidian and other rock sources has made an important contribution to research on interisland transport (e.g., J. Allen 1984; M. Allen and Bell 1988; Ambrose 1976; Ambrose and Green 1972; Best 1987; Green 1987). Characterization methods have included petrographic determinations; a range of major, minor, and trace element analyses; and sorting by measurements of specific gravity (see M. Allen and Bell 1988). As results from across the Pacific—especially those from Melanesia, New Zealand, and Hawai'i—show, these methods are generating valuable data on the distributions of lithic resources.

Ceramic Studies

Archaeological inferences concerning the inter-island transport of ceramics are based upon compositional analyses. Petrography of sand temper in prehistoric pottery is the technique that has been most frequently employed. Other analyses use the range of mineralogical and elemental characterization techniques based on measurement with electromagnetic radiation. These techniques are often used on the clay portion of sherds, or on bulk (powdered, clay, and inclusion aggregate) sherd samples.

Sand Temper Petrography

In 1979 Dickinson and Shutler published a detailed overview of petrography of sand tempers in Pacific Islands pottery. They pointed out that islands in general are promising settings for the identification of indigenous versus exotic temper types. This is the case for the western Pacific because (1) "each island provides only limited exposures of restricted rock types"; (2) islands contain sand deposits with relatively restricted distributions when compared to the vast drainages and alluvial sediments found in continental environments; and (3) sands from different islands do not mix, except in deep ocean waters (Dickinson and Shutler 1979:1645). In addition, the islands of the western Pacific are situated along several distinctive tectonic belts, a fact that allows researchers to define discrete temper sand provinces based on geologic criteria (Dickinson and Shutler 1979).

In spite of these advantages, optical petrography has many limitations as a method to study the local versus exotic provenance of prehistoric pottery and/or its constituents. For example, the extent to which an area is documented geologically determines how accurately a particular temper might be assigned to a "source." Geologically complex zones, such as the Fiji Islands, that are also geologically well understood offer the greatest potential for fine-scale studies of temper "sourcing" and prehistoric movements. Zones of the western Pacific that are complex yet only poorly known geologically preclude definitive statements on temper sources. In the Oceanic basaltic zone (east of the andesite line that separates Tonga and Samoa) large-scale geologic similarities make specific temper sources difficult to assign. Given these factors and our uneven geological knowledge, the resolution possible for studies of provenance varies tremendously.

Another problem inherent to petrographic analysis of sand temper in pottery is its restriction to identification of mineral and rock fragments. As a result, the most commonly available and frequently used Oceanic tempering materials—calcareous beach sand/crushed shell—cannot be assigned to distinctive sources. Consequently, many assemblages cannot be fully segregated into local and exotic provenance on the basis of temper.

Other Methods

Methods other than petrography have been used sparingly in the compositional analysis of Pacific Island ceramics. Generally these methods have focused on the characterization of the clay matrix of the ceramic sherds; they have included X-ray diffraction, optical emission spectrography, and energy dispersive X-ray microanalysis. Proton-induced X-ray emission (PIXE) has been successfully used on prehistoric Papuan Gulf pottery (J. Allen and Duerden 1982; Rye and Duerden 1982) as well as for obsidian characterization (see M. Allen and Bell 1988).

Elemental microanalysis, using an energy dispersive X-ray spectrometer (EDS), is among the most promising of the varied methods used in ceramic characterization (see Bishop et al. 1982; Freestone and Middleton 1987; Rice 1987:402–403). One can analyze the clay matrix, individual temper grains or other inclusions, slips, pigments, residues, or any discrete area. Unlike several other physical-chemical methods, such as neutron activation analysis (NAA), the *bulk* (temper and clay together) characteristics of ceramics need *not* constitute the unit of analysis.

In spite of factors complicating microanalysis, this method is especially promising in comparison to the limitations of petrographic work outlined above. X-ray microanalysis allows multi-elemental characterization of clay in archaeological specimens. The kind of temper added to clay, or other technological factors of production, does not preclude reliable elemental microanalysis. Thus, unlike petrographic analysis, the entire ceramic assemblage can be sampled.

Data on variation in clays are useful in grouping multi-elemental characteristics that reflect different sources of clay used in pottery manufacture (Bishop 1980; Bishop and Neff 1989; Harbottle 1976). Under ideal conditions, reliable comparisons can be made between known clay sources and the clay used in relatively low-fired pottery (see Freestone 1982; Bishop et al. 1982; Harbottle 1976; Rapp 1985; Wilson 1978 for reviews). Elemental analysis using X-ray microanalysis has the *potential* of generating compositional data to distinguish individual clay sources and the pottery associated with them.

Stylistic Analysis

The question of the movement of ceramics has also been approached indirectly through the description and analysis of macroscopic observations, which typically have included decorative or stylistic attributes. For instance, although compositional analyses of Lapita pottery have become increasingly important as a means of documenting exchange, Green (1979) has also suggested that decorative motifs on Lapita vessels may be used to infer the occurrence of exotic pieces in different sites. Spoehr (1957:120) made a similar (although not well-substantiated) inference when he suggested tht Marianas Lime-Filled Impressed Ware was exchanged. Because the identification of exchange through the analysis of decorative attributes is not well understood or consistently applied in Oceania, we describe here the general conditions that are assumed to prevail and the procedures that may be used to identify exotic pieces.

Stylistic analyses of pottery involved in prehistoric exchange make several assumptions. The first is that communities of potters produce vessels associated with distinctive decoration. Second, the movement of these distinctive vessels out of the community where they were produced will not exceed the importation of other vessels with alternative design systems. Obviously, the extent to which design systems are shared over increasingly large areas, either through interaction among potters or through the exchange of pots, affects the spatial resolution of decorative analyses. Furthermore, it can be difficult to distinguish the exchange of actual pots from the sharing of *ideas* regarding the decoration of pots. Nonetheless, when such assumptions are not greatly violated, decorative analyses can provide useful inferences regarding both the general location of particular stylistic occurrences and the identification of exotic pieces.

For a decorative analysis to succeed, however, it is necessary to work with assemblages of pottery from a region sufficiently large to encompass the production locales represented. Pottery assemblages must be consistently analyzed in order to characterize the distinctive styles that occur. Then these decorative characteristics must be studied to determine if they have spatial distributions that are not identical. The identification of characteristics that are spatially distinct (i.e., do not show much overlap) can then be used to infer production locales. Exchange can be inferred when pottery associated with many of the characteristics of one locale is found in an assemblage recovered from another, spatially distinct locale.

This approach to identifying exchange is not without its analytic problems (e.g., satisfaction of the underlying assumptions, adequate assemblage size, and comparable classificatory systems), and we do not advocate its uncritical use. It can work, however, and more important, it can be used as a first step in analyzing artifact assemblages to detect large-scale spatial patterning. This, in turn, can provide the basis for selecting materials for compositional analysis to determine provenance.

The study of exchange and interaction in the Pacific requires detailed distributions of artifacts, with their macroscopic characteristics coupled with data on artifact provenance. Provenance is determined through characterization studies of materials. In order to generate these distributional patterns, many assemblages must be analyzed so as to address production and exchange at a *regional* level. Such critical regional-level studies will become possible only as analyses of comparable rigor are completed for particular artifact assemblages. From these follows the recognition of the broad areal and regional patterns of exchange, and the degree of interaction. Technical problems of characterization of materials must be resolved regardless of the theoretical approach taken in explaining exchange, or offering exchange as an explanation for other human phenomena.

EXPLANATION

With respect to explanations for exchange, archaeologists have diligently sought cross-cultural generalizations, especially in attempts to assign sociological and behavioral meaning to artifact distributional patterns (e.g., Earle 1982). Archaeologists have had little success, however, in developing a coherent body of theory to explain how exchange operates and why it exists (Earle 1982:2–3). Unfortunately, appealing to sociocultural anthropology has yielded few theoretical insights for prehistorians.

Solutions have proven elusive for the second methodological problem that must be resolved in order to study exchange in the evolution of Oceanic societies. It requires linking theoretical constructs with real-world phenomena—the hard evidence of archaeology (cf. Dunnell 1982). We believe archaeologists have the unique opportunity to address questions of the evolution of exchange in both temporal and spatial dimensions. This opportunity reflects the greatest promise of archaeology: the documentation and explanation of long-term change in time and its expression of variability across space. Evolutionary theory, as applied to human phenomena, appears to be the appropriate tool for developing such explanations. Ideally, evolutionary explanations are possible by "deducing the consequences of evolutionary theory as employed in biology and as applicable to ethnographic data for artifacts, their frequencies and distributions" (Dunnell 1980:89).

In Darwinian evolutionary terms, understanding exchange and human interaction is critical for at least three reasons. First, exchange may play a crucial role with direct selective advantages in the colonization of new environments, in terms of both the distribution of critical economic resources and the procurement of mates in demographically unstable situations (Hunt 1989; Kirch 1988; Williamson and Sabath 1984). This selective advantage would continue beyond the early phases of island colonization as long as populations were demographically unstable or subject to shortages in critical resources. Second, exchange is a mechanism that maintains contact among communities that might otherwise be geographically isolated. This may be a key factor in explaining the persistence of ancestral traits with a resulting slow rate of evolutionary divergence over time (e.g., Hunt 1987). Third, exchange may play an integral part in the differential access of some individuals to critical resources, thus promoting hierarchical sociopolitical relations.

Selective Advantage

Kirch (1988) has recently suggested that exchange played an important adaptive role in Oceanic colonization, because it provided for the maintenance of contacts between small colonizing populations and larger parent communities. As Kirch (1988), Hunt (1989), Williamson and Sabath (1984), and other island biogeographers have pointed out, communication and exchange among small communities are an important mechanism in reducing the probability of extinction. Demographic extinction is caused by variation in age structure and sex ratio, which can become especially critical when population size is too small (a population of fewer than 80 individuals is quite vulnerable; McArthur et al. 1976; McArthur 1982; Williamson and Sabath 1984). As a consequence, the extinction probability is higher for small groups that are *not* in contact with a source population. In spite of the abundance of resources on a newly discovered island, colonizing groups could frequently face risks of demographic extinction unless they recruited mates from other populations.

Recent evolutionary ecological studies of human populations (e.g., Cashdan 1985; Winterhalder 1990; Smith 1988) have addressed the issue of strategic interactions among human populations. The significance of reciprocal exchange has been discussed in terms of the reduction of risk and uncertainty. Small and vulnerable founding populations colonizing dispersed and frequently distant islands would certainly face risk and uncertainty with respect to environmental variations, but they would have been especially vulnerable to demographic crises.

Cashdan (1985:456) has argued that participation in exchange networks can serve as a means of insurance—that is, a device for reducing risk by sharing losses. As Cashdan (1985:456) describes,

> a large number of independent exposure units are combined, thereby making the individual losses collectively predictable. By the law of large numbers, the larger the number of independent exposure units, the more closely the average loss approaches the expected loss. This predictable loss is then shared by all the exposure units, and the risk is reduced. The net effect for the individual, then, is to reduce the variance by substituting a certain, small loss for an uncertain, but potentially large one. For generalized reciprocity to act as a form of risk reduction, the risk facing the different individuals must be independent.

Alkire (1965) recorded an ethnographic case that appears to be an Oceanic example of exchange or interaction as a form of insurance. He points out that whether an island in the Carolines Archipelago of Micronesia can be settled in the first place depends on its size, its productive potential, *and* its participation in an exchange network. Alkire shows that survival of small populations depends on common membership in an overseas network that can offset disaster by redistributing critical resources and mates. Island biogeographers have called this the "rescue effect" (Brown and Kodric-Brown 1977). In Alkire's (1965) Micronesian case, groups from low coral islands, who in Cashdan's (1985) model would have insurable risks, did almost all of the voyaging associated with exchange. Hunt (1989) has recently developed this idea with respect to exchange among Lapita communities of the southwestern Pacific.

Interaction and Divergence

Exchange and communication are also of interest for explaining the persistence or divergence of transmitted similarities, whether diffused or inherited. Exchange is a mechanism that maintains contacts between communities that might otherwise be culturally, biologically, and linguistically isolated.

Hunt's (1987) study of linguistic variability in Fiji, for example, shows that the relative degree of isolation with geographic distance is a key variable in accounting for human evolutionary divergence. Geographic distance imposes costs in terms of transportation, travel time, and risk. Thus, geographic distance tends to constrain interaction and migration. At the lowest, or most proximal levels of interaction in a regional setting, the expectation is for sharp decline in measures of human similarity with even short distances. In these kinds of settings—as seen in patterns of interaction documented in the Solomon Islands, the Bismarcks, and the New Guinea mainland—the effects of drift under conditions of isolation are accorded great significance in determining patterns of human divergence. In contrast, very high levels of regional interaction, such as that documented for Micronesia, result in little isolation, and large areas may share strong similarities. At some intermediate level of interaction across a region, the model predicts a marked decline of similarity with geographic distance, as has been documented in the Fiji Islands.

Exchange and Social Complexity

Because exchange often involves interaction between members of different groups, it may contribute to cooperation and competition in economies that transcend the group in scale. Exchange relations over a geographic expanse can create economies of scale only fully integrated at regional levels. Exchange can also redistribute resources or forms of production that are unevenly distributed on a geographic basis. In many cases, regional integration has involved craft specialization and the filling of different economic niches by particular members of a community or by entire communities. The emergence of specialization and inter-group exchange is often offered as part of explanations for the origin of social complexity. These accounts are functionalist, and as Brumfiel and Earle (1987:3) point out, they assume that political elites organize a more efficient subsistence economy through acquisition and redistribution of resources. However, as Brumfiel and Earle (1987:3) argue, ethnographic and archaeological cases contradict such assumptions. In addition, it is unclear to what extent political elites involve themselves directly in the organization and direction of various forms of exchange. And in the cases where elites are involved in economic decision making, they may have motives of self-interest, such as expanding their power and controlling access to a limited set of valued resources.

Thus, we would suggest that exchange relations may be quite variable in complex societies, and that these relations originate and persist out of the varying characteristics by which groups are organized. Access to resources is, perhaps, the most important of these characteristics. It establishes the symmetry of exchange relations, and determines if exchange is being pursued out of the need for resources or the effort to enhance prestige. Complex societies are usually also typified by a political economy, to some extent separate from the subsistence economy of the general population. The most valued resources within the political economy are restricted, and both their production and exchange are monitored by elites. We have yet to develop suitable models that would allow us to understand how certain resources or products become established as media for exchange in a political economy dominated by elite individuals. It may be that the emphasis and higher value placed on selected products in a sector of the political economy enlarges the scale and scope of exchange at all levels of the society, thus providing greater overall productivity, larger population capacity, more interdependence among social groups, and ultimately greater authority for elites already in positions of power.

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